PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Improvements relating to Electrodialytic Cells

We, THE PERMUTIT COMPANY, LIMITED, a British company, of Permutit House, Gunnersbury Avenue, London, W.4, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

It is known to remove dissolved salts from liquids by passing the liquid in question through every alternate compartment of a multi-compartment electrodialytic cell in which the compartments are separated from one another by ion-selective membranes.

Processes of this kind are very suitable for the demineralisation of water by the passage of the water through compartments each bounded on one side by a cation-selective membrane and on the other side by an anion-selective membrane, while a second electrolyte (usually also water) flows through the remaining compartments to receive the ions transported through the membranes by the electric current flowing through the cell. When the total amount of dissolved solids in the water under treatment falls to about 500 ppm or is no more than this initially, it is necessary to apply so high a voltage to the cell that the process ceases to be economic.

It is also known to fill the compartments with granular ion-exchange material. The advantage of doing this is that the overall electrical resistance is reduced when the concentration of ionised dissolved solids in the liquid is low, and consequently water containing less than 500 ppm total dissolved solids can be economically treated.

The granular ion-exchange materials most widely used at the present time are resin beads of from 0.5 to 1 mm in diameter. Now the use of granules such as resin beads has several disadvantages. First, it is difficult to ensure that they are initially distributed evenly within a compartment and that the several compartments through which the liquid to be treated usually flows in parallel streams are evenly packed. If one compartment contains more granules than another, less liquid will flow through it than through the other. Next it is difficult to keep the granules in place in a compartment. At the best the packed mass of granules becomes displaced by the liquid, with the result that channelling with its attendant draw-backs occurs. It may even happen that some of the granules are swept out of the compartment to lodge in and clog the passage through which the liquid flows after leaving the compartment.

Again, the assembly of a cell containing granules is very tedious and it is difficult to prevent the granules from lodging between the surfaces which should mate to seal each compartment from the next. Further, where the packed mass of granules touches the membrane faces the geometry of the mass is different from that in the remainder of the mass, and more liquid tends to flow along the walls than through the bulk of the mass. This uneven flow is undesirable. Finally, if the compartments are packed with granules the total resistance to the flow of the liquid is increased and the cost of pumping the liquid through the cell is high.

In our Application No. 40078/57 (Serial No. 877,239) we have described and claimed cells in which we use not beads but sheets of material having ion-exchange properties.

In our present invention we use fibrous mats of ion-exchange resin. These mats physically resemble glass-fibre mats in consisting of random interlocked fibres. Such a mat may be produced by extruding a mixture of the resin and a binder, e.g. a mixture as described in our Application No. 3956/58 (Serial No. 858,137) through numerous fine orifices to produce threads and allowing the threads to move downwards onto a support to form a mat. Conveniently the threads may be severed into appropriate lengths as they move downwards. The diameter of the threads is determined essentially by the size of the spinneret orifices and may be, for example, from 70 to

250 μ, about 1502 μ being a convenient size.

The mats allow passage of liquid through the compartments while increasing the electrical conductivity therein. The mats may be put in all the compartments but in general it is enough to put them in those compartments through which the liquid under treatment flows and in which the electrolyte concentration is or becomes low.

The mats may all have ion-exchange properties of only one kind, but if it is desired to have both cation-exchange and anion-exchange material in a single compartment, mats of both kinds of material may be put in the compartment, or use may be made of a single mat containing some fibres having cation-exchange properties and some having anion-exchange properties, the mat being made by extruding two resins from different containers in such a way that the resultant threads intermingle.

The mats may advantageously be of substantially the same linear dimensions as the compartments. They may initially be thicker than the widths of the compartments and compressed when the whole assembly forming the cell is tightened up.

WHAT WE CLAIM IS:—

1. A multi-compartment electrodialytic cell in which the compartments are separated from one another by ion-selective membranes, and fibrous mats of ion-exchange resin are provided in some or all of the compartments to increase the electrical conductivity therein while allowing the passage of liquid therethrough.

2. A cell according to claim 1 in which the mats are of substantially the same linear dimensions as the compartments.

For the Applicants:—
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PROVISIONAL SPECIFICATION

Improvements relating to Electrodialytic Cells

We, THE PERMUTIT COMPANY LIMITED, a British Company, of Permutit House, Gunnersbury Avenue, London, W.4, do hereby declare this invention to be described in the following statement:—

In our Application No. 40078/57 (Serial No. 877,239) we have described a multi-compartment electrodialytic cell in which the compartments are separated from one another by ion-selective membranes and the compartments are filled with ion-exchange material in the form of pieces having at least one dimension, and preferably two dimensions, distinctly larger than those of ion-exchange resins beads which had previously been packed in a cell.

According to the present invention we fill compartments of a cell with a fibrous mat of ion-exchange resin. This mat physically resembles glass-fibre mats in consisting of random interlocked fibres. Such a mat may be produced by extruding the resin through numerous fine orifices to produce threads and allowing the threads to move downwards onto a support to form a mat. Conveniently the threads may be severed into appropriate lengths as they move downwards. The diameter of the threads is determined essentially by the size of the spinneret orifices and may be, for example, from 70 to 250μ, about 150μ being a convenient size.

As in our previous invention, the pieces formed by the mats may all have ion-exchange properties of only one kind, but if it is desired to have both cation-exchange and anion-exchange material in a single compartment, pieces of both kinds of material may be put in the compartment, or use may be made of a single mat containing some fibres having cation-exchange properties and some having anion-exchange properties, the mat being made by extruding two resins from different containers in such a way that the resultant threads intermingle.

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